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(54) Title: LIQUID FABRIC SOFTENERS CONTAINING MICROEMULSIFIED AMINO SILANES

(57) Abstract

This invention relates to liquid fabric care compositions comprising a microemulsified amine functional silicone for reducing fiber-fiber/yarn-yarn friction and a fabric softener. The microemulsified amine functional silicone is more effective than prior art amine functional silicone macroemulsions when used with a fabric softener. Preferred compositions are aqueous based fabric care and are used in the rinse cycle of a fabric care operation.

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Liquid fabric softeners containing microemulsified amino silanes

5

FIELD OF THE INVENTION

This invention relates to fabric care compositions and to a  
10 method for treating fabrics in order to improve various properties  
of the fabric, in particular, reduction of fiber-fiber and yarn-  
yarn friction.

BACKGROUND OF THE INVENTION

The use of silicones for softening fabrics, i.e., providing  
15 lubrication between fibers and yarns so they move over one another  
more easily, has been well known for quite some time. In addition,  
the use of organomodified silicones for textile treatments  
has also been well documented over the years (See U.S. Pat. Nos.:  
20 4,620,878, Gee, issued Nov. 4, 1986; 4,705,704, Lane et al.,  
issued Nov. 10, 1987; 4,800,026, Coffindaffer et al., issued  
Jan. 24, 1989; 4,824,877, Glover et al., issued April 25, 1989;  
and 4,824,890, Glover et al., issued April 25, 1989; also of  
25 interest is Brit. Pat. Appln. 87-29,489, Walbeoff, published Dec.  
18, 1987, all of said patents and said application being in-  
corporated herein by reference). Silicones of this type are  
typically delivered to textiles in the form of an aqueous emul-  
sion. More recently, much work has concentrated on the aqueous  
30 delivery of these systems via microemulsions. The above art  
suggests that microemulsions have two advantages over conventional  
"macro" emulsions: (1) they are more stable and (2) they require  
less mechanical energy to make.

While hand evaluation of fabrics to determine softness is  
still practiced widely, about 20 years ago Dr. Sueo Kawabata et  
al. began evaluating textiles via a mechanical approach. They  
35 designed instruments to measure low deformation forces, typical of  
hand analysis, on fabrics. Although these instruments (commonly  
known as the Kawabata Evaluation System or KES) were designed to  
be quality control tools for fabric acceptance, the instruments

have also been used to study the effect of fabric treatments. Two such studies have been published by Union Carbide Co.: Sabia, A.J. and Pagluighi, A.M., Textile Chemist and Colorist, Vol. 19, No. 3, March 1987, p. 5; and Barndt, H.J., Sabia, A.J. and Pagluighi, A.M., Textile Chemist and Colorist, Vol. 21, No. 12, December 1989, p. 16. The shearing instrument, in particular the shearing hysteresis measurement, is believed to be indicative of the ease with which fibers and/or yarns move over one another. Thus, the lower the shear hysteresis value, the better the lubricant.

The term "reduced fiber-fiber/yarn-yarn friction" (reduced friction between individual fibers within the yarn as well as between the yarn strands) as used herein means that the fabric exhibits a lower shear hysteresis value as measured by the KES shearing instrument. While not wishing to be bound by theory, it is believed that a reduction in reduced fiber-fiber/yarn-yarn friction provides better drape, hand, and wrinkle removal during tumble drying and ironing processes due to the fibers being more easily moved over one another.

#### SUMMARY OF THE INVENTION

This invention relates to fabric care compositions comprising a microemulsified amine functional silicone agent and a fabric softener for use in a fabric care operation whereby an effective amount of said microemulsified amine functional silicone is deposited on said fabric for reduced fiber-fiber/yarn-yarn friction.

#### DETAILED DESCRIPTION OF THE INVENTION

This invention relates to microemulsified amine functional silicone compositions for reduced fiber-fiber/yarn-yarn friction. In another respect this invention relates to methods of using such microemulsified amine functional silicone compositions in the care of fabrics for reduced fiber-fiber/yarn-yarn friction. Preferred compositions are aqueous fabric softeners. Such compositions are usually added to either the wash or rinse water of a laundering operation. These preferred compositions are aqueous based, water-dispersible compositions which contain from about 0.05% to about 25%, more preferably from about 0.1% to about 15% of the microemulsified amine functional silicones. The compositions are diluted in the wash or rinse.

Surprisingly, the Microemulsified Amine Functional Silicones (MAFS) incorporated into a liquid fabric softener composition exhibit a synergistic behavior when compared to the corresponding "macro" emulsified material. Said differently, used by itself, 5 the MAFS performance for reduced fiber-fiber/yarn-yarn friction is not as good as that of the macroemulsified system; however, in the context of a liquid fabric softener composition the MAFS composition provides a greater reduction in shear hysteresis values than the corresponding macroemulsion in an analogous liquid fabric 10 softener composition.

A preferred embodiment comprises: a liquid rinse water composition comprising the microemulsified amine functional silicone plus fabric softener, preferably quaternary ammonium fabric softener.

15 In a preferred execution, about 0.1% to about 10% by weight of microemulsified amine functional silicone is mixed into any suitable prior art laundry liquid fabric softener composition. The result is a fabric care composition that provides a reduced fiber-fiber/yarn-yarn friction benefit to the treated fabric.

20 Silicone Microemulsions

Over the last 5 years, there have been many patents published in the area of silicone microemulsions (U.S. Pat. Nos.: 4,620,878; 4,705,704; 4,824,877; 4,824,890, all supra; also of interest is Brit. Pat. 87-29,489, supra; all of said patents and said application being incorporated herein by reference). In this literature, 25 silicone microemulsions have been described as translucent silicone emulsions with average particle sizes smaller than 0.14 microns. In this art, microemulsions are taught as having two advantages over conventional "macro" emulsions: (1) they are more stable and (2) they require less mechanical energy to make. There is no disclosure either that microemulsions can reduce fiber to fiber and/or yarn to yarn friction as compared to macroemulsions when used with a fabric softener. Since microemulsions are 30 inferior in performance to macroemulsions when used alone, any investigation which starts logically with the individual dispersions would discourage further investigation.

35 The amine functional silicones herein preferably have an average molecular weight of from about 1,000 to about 100,000,

5 preferably from about 1,000 to 50,000, more preferably from about 1,500 to about 20,000, and can be prepared by emulsion polymerization of low molecular weight polymers and/or monomers, more preferably low molecular weight polymers. Emulsion polymerization can provide a high concentration of microemulsified silicone.

Some Preferred Embodiments

10 The preferred composition of this invention is an aqueous dispersion comprising: a microemulsified amine functional silicone wherein the weight ratio of microemulsified amine functional silicone to fabric softener is from about 17:1 to about 1:350, preferably from about 10:1 to about 1:100. Even more preferred weight ratios of microemulsified amine functional silicone to fabric softener are from about 1:1 to about 1:10, and more preferably, from about 1:5 to about 1:10. These compositions are added 15 to the rinse water for reduced fiber-fiber/yarn-yarn friction and fabric softening benefits.

Suitable fabric softener(s) are selected from the group consisting of:

- 20 i. quaternary ammonium compound;  
ii. fatty amine compound;  
iii. fatty amide compound;  
iv. fatty acids;  
v. fatty alcohols; and  
vi. mixtures thereof.

25 In certain liquid rinse-added compositions of this invention the amount of fabric softener can range from about 2% to about 35%, preferably from about 4% to about 27%, by weight of the total composition. The lower limits are amounts needed to contribute effective fabric softening performance when added to laundry rinse 30 baths in the manner which is customary in home laundry practice. The higher limits are suitable for more concentrated liquid products which require either smaller volume usage or dilution prior to use.

35 The preferred levels of microemulsified amine functional silicone in such composition can range from about 0.05% to about 40%; preferably from about 0.1% to about 20%; and more preferably from about 0.5% to about 10% by weight of the concentrate.

Suitable fabric softener compounds include quaternary ammonium salts, as well as nonquaternary amines and amine salts.

Compositions containing cationic nitrogenous compounds in the form of quaternary ammonium salts and substituted imidazolinium salts having two long chain acyclic aliphatic hydrocarbon groups provide fabric softening benefits when used in laundry rinse operations. (See, for example, U.S. Pat. Nos. 3,644,203, Lamberti et al., issued Feb. 22, 1972; and 4,426,299, Verbruggen, issued Jan. 17, 1984; also "Cationic Surface Active Agents as Fabric Softeners," R.R. Egan, Journal of the American Oil Chemists' Society, January 1978, pages 118-121; and "How to Choose Cationics for Fabric Softeners," J.A. Ackerman, Journal of the American Oil Chemists' Society, June 1983, pp. 1166-1169).

Other suitable fabric softening compounds are the nonquaternary amides and the nonquaternary amines. A commonly cited material is the reaction product of higher fatty acids with hydroxy alkyl alkylene diamines. An example of these materials is the reaction product of higher fatty acids and hydroxyethylethylenediamine (See "Condensation Products from beta-hydroxyethyl-ethylenediamine and Fatty Acids or Their Alkyl Esters and Their Application as Textile Softeners in Washing Agents," H.W. Eckert, Fette-Seifen-Anstrichmittel, September 1972, pages 527-533). These materials are usually cited generically along with other cationic quaternary ammonium salts and imidazolinium salts as softening actives in fabric softening compositions. (See U.S. Pat. Nos. 4,460,485, Rapisarda et al., issued July 17, 1984; 4,421,792, Rudy et al., issued Dec. 20, 1983; 4,327,133, Rudy et al., issued April 27, 1982).

A particularly preferred fabric softener is in the form of an aqueous dispersion comprising from about 3% to about 35% by weight of a mixture consisting of:

- (a) from about 10% to about 92% of the reaction product of a higher fatty acid with a polyamine selected from the group consisting of hydroxyalkylalkylenediamines and dialkylenetriamines and mixtures thereof, and
- (b) from about 8% to about 90% of cationic nitrogenous salts having only one long chain acyclic aliphatic C<sub>15</sub>-C<sub>22</sub> hydrocarbon group, and optionally,

- (c) from 0% to about 80% of a cationic nitrogenous salt having two or more long chain acyclic aliphatic C<sub>15</sub>-C<sub>22</sub> hydrocarbon groups or one said group and an arylalkyl group having from about 15 to about 22 carbon atoms in its alkyl chain.

For a detailed description of some preferred fabric softeners, see commonly assigned U.S. Pat. No. 4,661,269, Trinh/Wahl/Swartley/Hemingway, issued Apr. 28, 1987, incorporated herein by reference in its entirety.

10 The terms herein, e.g., softener compound, in general, denotes both singular and plural unless otherwise specified.

Preferred carriers are liquids selected from the group consisting of water and mixtures of water and short chain C<sub>1</sub>-C<sub>4</sub> monohydric alcohols. The water which is used can be distilled, deionized, and/or tap water. Mixtures of water and up to about 10%, preferably less than about 5%, of short chain alcohol such as ethanol, propanol, isopropanol or butanol, and mixtures thereof, are also useful as the carrier liquid. Carriers which are primarily water are desirable.

20 Some short chain alcohols are present in commercially avail-  
able quaternary ammonium compound products. Such products can be  
used in the preparation of preferred aqueous compositions of the  
present invention. The short chain alcohols are normally present  
in such products at a level of from about 0.5% to about 10% by  
25 weight of the aqueous compositions.

## Some Optional Ingredients and Preferred Embodiments

30      Compatible adjuvants can be added to the compositions herein  
for their known purposes. Such adjuvants include, but are not  
limited to, viscosity control agents, perfumes, emulsifiers, pre-  
servatives, antioxidants, bactericides, fungicides, colorants,  
dyes, fluorescent dyes, brighteners, opacifiers, freeze-thaw  
control agents, soil release agents, and shrinkage control agents;  
and other agents to provide ease of ironing (e.g., starches,  
etc.). These adjuvants, if used, are added at their usual levels,  
35      generally each of up to about 5% by weight of the preferred liquid  
composition.

Viscosity control agents can be organic or inorganic in nature. Examples of organic viscosity modifiers are fatty acids

and esters, fatty alcohols, and water-miscible solvents such as short chain alcohols. Examples of inorganic viscosity control agents are water-soluble ionizable salts. A wide variety of ionizable salts can be used. Examples of suitable salts are the halides of the group IA and IIA metals of the Periodic Table of the Elements, e.g., calcium chloride, magnesium chloride, sodium chloride, potassium bromide, and lithium chloride. Calcium chloride is preferred. The ionizable salts are particularly useful during the process of mixing the ingredients to make the liquid compositions herein, and later to obtain the desired viscosity. The amount of ionizable salts used depends on the amount of active ingredients used in such compositions and can be adjusted according to the desires of the formulator. Typical levels of salts used to control the composition viscosity are from about 20 to about 6,000 parts per million (ppm), preferably from about 20 to about 4,000 ppm by weight of the composition.

Soil release agents, usually polymers, are desirable additives at levels of from about 0.1% to about 5%. Suitable soil release agents are disclosed in U.S. Pat. Nos. 4,702,857, Gosselink, issued Oct. 27, 1987; 4,711,730, Gosselink and Diehl, issued Dec. 8, 1987; 4,713,194, Gosselink issued Dec. 15, 1987; and mixtures thereof, said patents being incorporated herein by reference. Other soil release polymers are disclosed in U.S. Pat. Nos.: 4,749,596, Evans, Huntington, Stewart, Wolf, and Zimmerer, issued June 7, 1988; 3,928,213, Temple, Heuring, and Prentice, issued Dec. 23, 1975; 4,136,038, Pracht and Burns, issued Jan. 23, 1979; and 4,661,267, Dekker, Konig, Straathof, and Gosselink, issued Apr. 28, 1987, said patents being incorporated herein by reference.

Typical levels of compatible bactericides used in the present compositions are from about 1 to about 1,500 ppm by weight of the composition.

Examples of antioxidants that can be added to the compositions of this invention are propyl gallate, available from Eastman Chemical Products, Inc., under the trade names Tenox® PG and Tenox S-1, and butylated hydroxy toluene, available from UOP Process Division under the trade name Sustane® BHT.

The compositions can contain other silicone fluids to provide additional benefits such as improved fabric feel. The preferred adjunct silicones are polydimethylsiloxanes of viscosity of from about 100 centistokes (cs) to about 100,000 cs, preferably from 5 about 200 cs to about 60,000 cs. These adjunct silicones can be used as is, or can be conveniently added to the softener compositions in a preemulsified form which is obtainable directly from suppliers. Examples of these preemulsified silicones are 60% 10 emulsion of polydimethylsiloxane (350 cs) sold by Dow Corning Corporation under the trade name DOW CORNING® 1157 Fluid and 50% emulsion of polydimethylsiloxane (10,000 cs) sold by General Electric Company under the trade name General Electric® SM 2140 Silicones. The optional silicone component can be used in an amount of from about 0.1% to about 6% by weight of the composition.

A preferred composition contains from about 1 ppm to about 1,000 ppm of bactericide, from about 0.2% to about 2% of perfume, from 0% to about 3% of polydimethylsiloxane, from 0% to about 0.4% of calcium chloride, from about 10 ppm to about 100 ppm of dye, 20 and from 0% to about 10% of short chain alcohols, by weight of the total composition.

The pH of the preferred compositions of this invention is generally adjusted to be in the range of from about 2 to about 11, 25 preferably from about 2 to about 8. Adjustment of pH is normally carried out by including a small quantity of free acid or free base in the formulation. Any acidic material can be used; its selection can be made by anyone skilled in the softener arts on the basis of cost, availability, safety, etc. Any suitable acid can be used to adjust pH. Preferred are hydrochloric, sulfuric, 30 phosphoric and formic acid. Similarly, any suitable base, e.g., sodium hydroxide, can also be used to adjust pH. For the purposes of this invention, pH is measured by a glass electrode in full strength softening composition in comparison with a standard calomel reference electrode.

35 The compositions of the present invention can be prepared by a number of methods. Some convenient and satisfactory methods are disclosed in the following nonlimiting examples.

All parts, percentages, and ratios herein are by weight unless otherwise specified.

EXAMPLE I

Procedure A

5       A liquid fabric softener composition containing a micro emulsified amine curable silicone is prepared in the following manner. About 4.33 parts di(hydrogenated tallow)dimethylammonium chloride (DTDMAC), about 1.00 part methyl-1-tallow amidoethyl-  
10      2-tallowimidazolinium methylsulfate and about 0.025 parts of a 1% dye solution are weighed into a premix vessel.

15      After heating to about 75°C and mixing, the premix is added, with agitation, to a mix vessel (44°C) containing about 88.14 parts distilled water and about 0.025 parts antioxidant solution. Then about 0.45 parts of perfume is added to this "main" mix. The main mix is then cooled to about 21°C, to which is added, with stirring, about 7.15 parts amine functional silicone microemulsion (about 14% silicone).

Procedure B

20      Same as Procedure A, except that the amine functional silicone microemulsion is incorporated into the main mix prior to cooling of the mix to 21°C.

TABLE 1

	<u>Ingredient</u>	<u>A and B</u>
		<u>Approx. Wt.%</u>
25	DTDMAC <sup>1</sup>	4.33
	Methyl-1-tallowamidoethyl-	
	2-tallowimidazolinium	
	methylsulfate	1.00
30	Alcohol (from actives)	0.80
	Perfume	0.45
	Dye Solution <sup>4</sup>	0.025
	Micro Emulsified Amine	
	Functional Silicone <sup>2</sup>	7.15
	Antioxidant <sup>3</sup>	0.025
35	Distilled Water	86.12

<sup>1</sup> Di(hydrogenated tallow)dimethyl ammonium chloride

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2 A specialty aqueous microemulsion X2-8406 made by Dow Corning Company. It contains about 14% amine functional silicone Dow Corning Q2-8075 and a proprietary emulsification system.

3 Tenox S-1 supplied by Eastman Kodak.

5 4 A 1% solution of Polar Brilliant Blue.

EXAMPLE II

A microemulsified amine functional silicone and fabric softener composition is prepared using Procedure A. The approximate levels of the ingredients are: 2.00 parts Mazamide 6, 0.80 parts MTTMAC, 4.03 parts DTDMAC (defined hereinbefore), 1.00 parts of the imidazolinium salt in Example I, 0.42 parts perfume, 1.28 parts alcohol (from actives), 10.00 parts 14% microemulsified amine functional silicone, and the balance is distilled water. See Table 2 and Example I for a recap of the ingredients and method of preparation.

EXAMPLE III

A microemulsified amine functional silicone and fabric softener composition is prepared using Procedure A. The approximate levels of ingredients are: 17.50 parts Mazamide 6, 6.50 parts DTDMAC, 1.32 parts perfume, 2.07 parts alcohol (from actives), 12.00 parts 14% micro emulsified amine functional silicone, and the balance is distilled water. See Table 2 and Example I for a recap of the ingredients and method of preparation.

25

TABLE 2

		Example II	Example III
	<u>Ingredient</u>	<u>Approx. Wt.%</u>	<u>Approx. Wt.%</u>
	Mazamide 6 <sup>1</sup>	2.00	17.50
	MTTMAC <sup>2</sup>	0.80	-
30	DTDMAC <sup>3</sup>	4.03	6.53
	Perfume	0.42	1.32
	Polar Brilliant Blue		
	Dye Solution	0.025	0.072
	Alcohol (from actives)	1.28	2.07
35	Microemulsified Amine Functional Silicone <sup>4</sup>	10.00	12.00
	Distilled Water	Balance	Balance

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- 1 Reaction product of 2 moles of hydrogenated tallow fatty acid with 1 mole of N-2-hydroxyethylenediamine.  
2 Mono(hydrogenated tallow)trimethyl ammonium chloride (MTTMAC).  
3 Di(hydrogenated tallow)dimethyl ammonium chloride.  
5 4 Dow Corning X2-8406 (described hereinabove).

#### EXAMPLE IV

10 Intrinsic performance of: Q2-7224 (macroemulsion of Q2-8075, 35% silicone) vs. X2-8406 (microemulsion of Q2-8075, 14% silicone). 9.34 grams of Q2-7224 and 23.35 grams of X2-8406 are used as rinse-added fabric softeners to treat poly-cotton (65%/35%) fabrics (concentration of about 50 ppm in the rinse). The fabrics are treated via one wash (no detergent)/rinse/dry treatment. Shear hysteresis measurements are completed on four fabrics of each treatment. The results below show Q2-7224 to be the better softener system for reducing fiber-fiber and yarn-yarn friction.

#### Chart 1

Average Shear Hysteresis (gf/cm) at 2-1/2° and 400g force

	X2-8406	Q2-7224
20	1.53	1.35

Significant at >95% confidence based on a paired t-test calculation.

#### EXAMPLE V

##### Product C

25 A microemulsified amine functional silicone and fabric softener composition is prepared using Procedure A. The approximate levels of ingredients are: 3.75 parts DTDMAC, 3.40 parts imidazoline, 0.57 parts MTTMAC, 0.40 parts perfume, 0.025 parts dye, 0.77 parts alcohol (from actives), 0.4-0.9 parts HCl, 7.15 parts MAFS (14%) and the balance is distilled water. This composition contains about 1% amine functional silicone fluid.

##### Comparative Product D

35 A fabric softener composition is prepared as in Product C, except that about 3.03 parts amine functional silicone macroemulsion (33% silicone) is added. This composition contains about 1% amine functional silicone fluid.

See Table 3, for a recap of ingredients for Products C and D. Both Products C and D contain about 1% Q2-8075 amine functional silicone fluid.

Products C & D are used as rinse-added fabric softeners to treat poly cotton (65%/35%) fabrics. The fabrics are treated via one wash/rinse/dry treatment. The detergents used are TIDE® and LIQUID TIDE®. Six sets (DOWNY®, DOWNY plus X2-8406, and DOWNY plus Q2-7224) of swatches saw only TIDE, 6 sets (DOWNY plus X2-8406, and DOWNY plus Q2-7224) of swatches only LIQUID TIDE. Keeping the LIQUID TIDE and TIDE washed fabrics separate, the fabrics were subjected to shear hysteresis measurements. The results below show X2-8406 fabric softener composition to be the better composition for reducing shear hysteresis than the corresponding Q2-8075 composition.

15

### Chart 2

Average Shear Hysteresis (gf/cm) at 2-1/2° and 400g force

		DOWNY® +		
		DOWNY®	Q2-7224	X2-8406
	TIDE Wash	.69	.71	.65 (a)
	LIQUID TIDE Wash	.88	.78	.76 (b)
	Average	.79	.74	.71 (c)

25

(a) Significantly lower than DOWNY + Q2-7224 at >95% confidence based on a paired t-test comparison. Significantly lower than DOWNY at >95% confidence based on a paired t-test comparison.

30

(b) Significantly lower than DOWNY + Q2-7224 at ≥70% confidence. Significantly lower than DOWNY at >95% confidence.

35

(c) Significantly lower than DOWNY + Q2-7224 at >95% confidence. Significantly lower than DOWNY at >95% confidence.

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TABLE 3

	<u>Ingredient</u>	<u>Example V</u>	
		<u>Product C</u> <u>Approx. Wt.%</u>	<u>Product D</u> <u>Approx. Wt.%</u>
5	MTT MAC <sup>1</sup>	0.57	0.57
	DTDMAC <sup>2</sup>	3.75	3.75
	Imidazoline <sup>3</sup>	3.40	3.40
	Perfume	0.40	0.40
10	Polar Brilliant Blue		
	Dye Solution	0.025	0.025
	Alcohol (from actives)	0.77	0.77
	Microemulsified Amine		
	Functional Silicone <sup>4</sup> (14%)	7.15	-
15	Macroemulsified Amine		
	Functional Silicone <sup>5</sup>	-	3.03
	HCl (31.5%)	0.4-0.9	0.4-0.9
	Distilled Water	Balance	Balance

20     <sup>1</sup> Mono(hydrogenated tallow)trimethyl ammonium chloride2     <sup>2</sup> Di(hydrogenated tallow)dimethyl ammonium chloride3     <sup>3</sup> 1-hydrogenated tallow amidoethyl-2-hydrogenated tallow imidazoline

4     Dow Corning X2-8406 (described hereinabove)

25     <sup>5</sup> Dow Corning Q2-7224, a macroemulsion analogue of the  
microemulsified X2-8406 also containing Dow Corning Q2-8075  
silicone fluid.30     The incorporation of the microemulsified amine functional  
silicone delivered via a liquid fabric softener matrix shows  
improved reduction in shear hysteresis on poly-cotton fabric  
relative to the traditional macroemulsion delivered via a liquid  
fabric softener matrix.

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Claims

1. A liquid fabric care composition comprising:
  - (1) a suitable microemulsified amine functional silicone for improved reduction of fiber-fiber/yarn-yarn friction;
  - (2) an effective amount of fabric softener; and
  - (3) a suitable carrier for (1) and (2).
2. The fabric care composition of Claim 1 which contains from about 0.05% to about 25%, preferably from about 0.1% to about 15%, more preferably from about 0.5% to about 10%, by weight of said microemulsified amine functional silicone.
3. The fabric care composition of Claim 1 or Claim 2 wherein:
  - (a) said microemulsified amine functional silicone has an average molecular weight of from about 1,000 to about 100,000; and
  - (b) said fabric softener is present at a level of from about 2%, preferably 3%, to about 35% by weight of the total composition:wherein the weight ratio of microemulsified amine functional silicone to fabric softener is from about 17:1 to about 1:350.
4. The fabric care composition of any of the above Claims wherein the weight ratio of said microemulsified amine functional silicone to said fabric softener is from about 10:1 to about 1:100, preferably from about 1:1 to about 1:10, more preferably from about 1:5 to about 1:10.
5. The fabric care composition of any of the above Claims wherein said microemulsified amine functional silicone has an average molecular weight of from about 1,000 to about 100,000, preferably from about 1,000 to about 50,000, more preferably from about 1,500 to about 20,000, and is made by emulsion polymerization of lower molecular weight silicone polymers, silicone monomers, or mixtures thereof, preferably lower molecular weight silicone polymers.

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6. The fabric care composition of any of the above Claims wherein said fabric softener is selected from the group consisting of:

- i. quaternary ammonium compounds;
- ii. fatty amine fabric softening compounds;
- iii. fatty amide compounds;
- iv. fatty acids;
- v. fatty alcohols; and
- vi. mixtures thereof.

7. The fabric care composition of any of the above Claims wherein said fabric softener comprises quaternary ammonium compound, preferably a mixture of amide, amine and quaternary ammonium compounds.

8. The fabric care composition of any of Claims 1-6 wherein said fabric softener comprises amine compound.

9. The liquid fabric care composition of any of the above Claims wherein said suitable carrier is primarily water and the level of said fabric softener is from about 4% to about 27%.

10. A method of reducing fiber-fiber/yarn-yard friction in treated fabrics comprising contacting said fabrics with an effective amount of the composition of any of the above Claims diluted with water.

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 91/04729

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all)<sup>6</sup>

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 C11D3/16 ; C11D3/37 ; C11D3/00 ; D06M15/65

## II. FIELDS SEARCHED

Minimum Documentation Searched<sup>7</sup>

Classification System	Classification Symbols		
Int.Cl. 5	C11D	D06M	C10M

Documentation Searched other than Minimum Documentation  
to the Extent that such Documents are Included in the Fields Searched<sup>8</sup>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup>

Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
Y	EP,A,0 300 525 (PROCTER & GAMBLE) 25 January 1989 see the whole document & US,A,4 800 026 24 January 1989 ---	1-10
Y	US,A,4 661 577 (K.J. LANE ET AL.) 28 April 1987 see column 1, lines 1 to 15; column 5, lines 45 to 65; example 7 & US,A,4 705 704 10 November 1987 ---	1-10
P,X	EP,A,0 417 047 (SANDOZ) 13 March 1991 see the whole document ---	1,10
A	EP,A,0 150 872 (PROCTER & GAMBLE) 7 August 1985 see page 8, line 1 - line 8; claim 1; example 10 ---	1-9
A	EP,A,0 075 990 (PROCTER & GAMBLE) 6 April 1983 see claims 1,6; example 1 ---	1-9
		-/-

<sup>10</sup> Special categories of cited documents :<sup>10</sup>

- <sup>"A"</sup> document defining the general state of the art which is not considered to be of particular relevance
- <sup>"E"</sup> earlier document but published on or after the international filing date
- <sup>"L"</sup> document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- <sup>"O"</sup> document referring to an oral disclosure, use, exhibition or other means
- <sup>"P"</sup> document published prior to the international filing date but later than the priority date claimed

<sup>"T"</sup> later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention<sup>"X"</sup> document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step<sup>"Y"</sup> document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.<sup>"&"</sup> document member of the same patent family

## IV. CERTIFICATION

Date of the Actual Completion of the International Search

30 OCTOBER 1991

Date of Mailing of this International Search Report

21.11.91

International Searching Authority

EUROPEAN PATENT OFFICE

Signature of Authorized Officer

GRITTERN A.G.

## III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category <sup>a</sup>	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	FR,A,2 318 268 (PROCTER & GAMBLE) 11 February 1977 see claim 1  ----	1-7

**ANNEX TO THE INTERNATIONAL SEARCH REPORT**  
**ON INTERNATIONAL PATENT APPLICATION NO. US 9104729**  
**SA 49424**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.  
 The members are as contained in the European Patent Office EDP file on  
 The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information. 30/10/91

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